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The JOURNAL OF ELECTRICITY
POWER AND GAS
WITH WHICH IS INCORPORATED
The Engineers', Architects' and Builders' News

PUBLISHED WEEKLY

BY THE TECHNICAL PUBLISHING COMPANY, ATLAS BUILDING, 604 MISSION STREET, SAN FRANCISCO CAL.
Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879.

VOL. XIX. No. 21 — SAN FRANCISCO, CAL., November 23, 1907. — Yearly subscription $2.50 Single copies 10 cents Back numbers prior to current month 25 cents.

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The Engineers', Architects' and Builders' News

VOLUME XIX. SAN FRANCISCO, CAL., NOVEMBER 23, 1907 No. 21

MAGNETITE HEADLIGHT.

By G. N. CHAMBERLIN.

The characteristics of the metallic or magnetite arc which have made the system an important factor in street illumination are now well understood. The details of arc control, electrode composition and lamp mechanism have been perfected and about 15,000 lamps are in successful operation.

The demand for a powerful and reliable headlight has increased rapidly with the extension of high speed inter-urban railroads. These requirements until the present time, have been quite satisfactorily met by the enclosed arc headlight.

The new headlight which is shown in Fig. 1 is very similar in external appearance to the carbon headlight, and

ROAD ILLUMINATED WITH MAGNETITE HEADLIGHT.

The magnetite arc, which has made this street lighting system a success, is found to be ideal for locomotive and street car headlights.

consists of a galvanized sheet-steel casing about fifteen inches in diameter, nine inches deep, reinforced by iron door castings, making a rigid structure.

The mechanism is not of a regulating type, but so ar-

ranged as to strike an arc of a fixed length. With the slow rate of burning of the electrodes there are sufficient interruptions of the circuit incidental to regular operation to maintain the arc within safe voltage limits. This permits of a more simple and substantial construction, suitable for railroad service as found in high speed interurban cars. The lamp, together with reflector, being held in place by one wing nut on the back of the casing can be readily removed for inspection or repair (Fig. 2).

In order to protect the arc from air which might otherwise get between the sections of glass and the door, there

FIG. 1. MAGNETITE HEADLIGHT AND SERIES RESISTANCE.

are two separate panes used with the joints overlapped. The use of sections or slats instead of solid glass lessens the liability of breakage from extreme temperature changes.

At the focus of a highly polished metal reflector is the magnetite arc. The upper electrode is a "T" shaped copper forging. Having a life of 2000 to 3000 hours, it may be considered as non-consuming, and being stationary, forms an arc which remains in the focus of the reflector. This upper electrode is held at the bottom of the draft chimney, where the natural draft keeps the arc burning on the electrode ends and carries off the fumes of iron oxide. The chimney is covered at the top by a hinged shield so designed as to protect the arc from high winds and rain, and makes the tubes easily accessible for cleaning with a brush furnished for the purpose. The lower electrode consists of an iron tube one-half inch by five inches filled with material which will give the necessary vapor in the arc stream to produce an efficient luminous arc.

That the track illumination is most satisfactory is

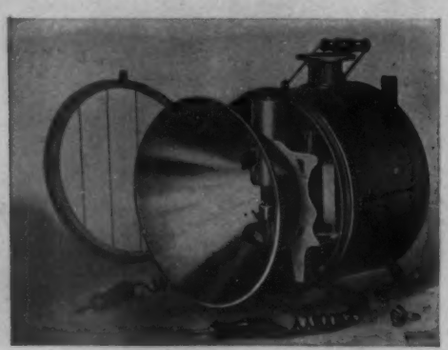


FIG. 2. MAGNETITE HEADLIGHT OPENED.

shown from illustration on page 174, which is a reproduction from a night photograph. The headlight not only illuminates the track for a distance of 1200 to 1800 feet ahead of the car, but the beam is exceptionally broad.

The magnetite headlight is designed to operate at seventy-five volts and four amperes. The difference between the line potential and arc potential may be taken up in the resistance shown in Fig. 3. While the use of such a dead resistance gives satisfactory operation, incandescent lamps for lighting the interior of the car may be employed instead, thereby utilizing the energy represented by the difference in voltage between line and arc. Different combinations of incandescent lamps can be used to make up this resistance, according to the number of lamps required to light the car. One very satisfactory combination is a group of sixteen 32 candle-power, 110 volt lamps, consisting of four series of four lamps each, connected in multiple. If it is desired to increase the number of lamps in the car, thirty-two 16 candle-power lamps may be used, in eight series of four lamps each, connected in multiple.

If it is desired to keep these incandescent lamps burning when the headlight is removed, or while it is being transferred from one end of the car to the other, a substantial resistance unit may be employed, wired up to a pair of two-way snap switches, one placed at each end of the car. This arrangement permits the headlight to be turned on or off without interfering with the incandescent lamp. Suit-

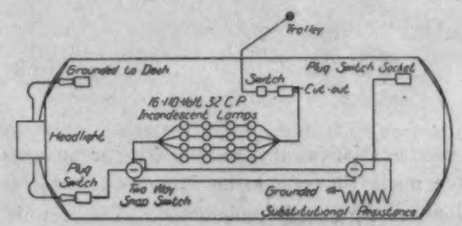


FIG. 3. DIAGRAM OF CAR AND HEADLIGHT WIRING.

able connections for this arrangement are shown in Fig. 3.

The vapors which make the metallic arc of high illuminating value comes from the negative electrode, so it is evident that in order to get this high candle-power arc, the lower or composition stick must be negative. This peculiar characteristic may be further taken advantage of in producing a dimmed light, where one is required for certain sections of the car route. With the current reversed and reduced to two and one-half amperes, a copper arc of low efficiency is produced of an intensity suitable for city operation. Fig. 4 shows suitable wiring for such connections. This two-part resistance will be furnished when required and the advantage of an available switch within reach of the motorman for immediately dimming the light will be appreciated by anyone approaching in another street car, automobile or other vehicle.

Several of these new headlights have been in actual operation on high speed interurban cars for several months, giving in each case very gratifying results. That this new headlight must practically supersede the enclosed headlight, is evident from a review of the following advantages:

1st.—The higher efficiency of the magnetite arc giving

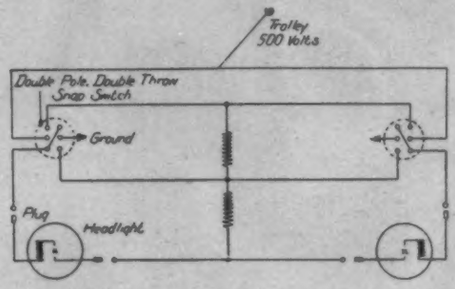


FIG. 4. REVERSING SWITCH AND WIRING.

quantity and quality of illumination.

2nd.—Arc maintained at focus of reflector, insuring permanent direction of rays.

3rd.—No enclosing globe used, thereby eliminating greatest expense of enclosed headlight maintenance.

4th.—Long life of electrodes—2000 to 3000 hours for upper, fifty to seventy-five hours for lower, showing a further reduction in operating expense.

5th.—Available means of quickly and effectually dimming the light—a modern method as compared with the use of screens hung in front of headlight door.

WATER-POWER POSSIBILITIES IN SOUTH AMERICA.

By Lewis R. Freeman.

During a recent tour in South America, says the writer, in a recent issue of "Power," he chanced to arrive in the interesting and progressive city of Santiago at the height of the worst coal famine Chile had ever known. A heavily increased consumption, due to industrial expansion in all directions and some very questionable tactics on the part of the government railway management in endeavoring to secure control of the local output, had conspired to bring about a big shortage in the country's coal supply at a time when the fierce "northers" that sweep the Chilean coast during the winter made it practically inpossible for sailing vessels to venture there. Before a fleet of especially chartered steam colliers brought tardy and costly relief, all the good coal in the country had been completely exhausted, and the wretched pickings from the dumps of the Lota and Coronel mines were selling at the equivalent of eight, and even ten, dollars in United States gold per ton.

In Valparaiso and Santiago electric cars ran on only three or four of the principal routes, and these were stopped early each afternoon in order to save coal to run the dynamos that furnished electricity for the few widely scattered street lights that were still kept burning. In the smaller cities of from 20,000 to 100,000 inhabitants, such as Talca, Chillan and Concepcion, conditions were even worse, passengers being conveyed only in cabs, while at night all the streets were in absolute darkness.

It was in the midst of this period of Egyptian night that the German company holding the lighting and street-transportation concessions in Valparaiso completed and put in operation a modern installation of turbines, driven by water from a fall near Panuelos, ten miles distant from the city. Something between 5,000 and 6,000 horse-power became instantly available, as a result of which the streets and parks of the city blazed forth once more with light, and the trolley service was re-established with more cars and faster schedules than ever before. The rest of the country, wrapped in darkness for another two months, had ample time to contemplate at leisure the example set for it, and to get the lesson to be learned therefrom well in mind for future reference.

For many weeks the most quoted remark to be heard on the West coast was the closing sentence of a statement made in a newspaper interview by an American engineer who chanced to be in Santiago at the time. After pointing out that Western South America had more favorable opportunity for the generation of electricity from water power than any other portion of the globe, he concluded by saying:

"Under the circumstances, therefore, Chile, with all the fuss she has made over her losses and sufferings as a result of the coal famine, has about as much claim to sympathy as a man who stands up to his neck in a pool of clear water and cries for a drink because he is thirsty."

In the generation of electricity from water power, the two great essentials are fall and continuity of supply. Given sufficient of both at a place within practicable transmitting distance of the points where the electricity is to be used, power from water may ordinarily be produced cheaply enough to enter into successful competition with that generated in a steam plant, even in such sections as New York State, in the East, and Washington and California, in the West, where steam-fuels of all descriptions may be bought at minimum prices.

If conditions favorable to the generation of electricity from water power exist in a settled country where neither coal nor oil is found, and the price of electricity for lighting and traction purposes is high as a consequence, installations of that character, even after giving the country the benefit of lower-priced power, will yield the handsomest of profits. It is to the opportunities of this description offered at countless points on both slopes of the South American Andes that it is desired to call attention in this article.

Coal Production a Negligible Quantity.

The coal production of South America may, for all practical purposes, be considered as an almost negligible quantity. The only mines on the whole continent that are being worked are those in the vicinity of Coronel and Lota in southern Chile, mines which turn out so poor an average product that they are generally referred to as stone-quarries. Almost all the coal consumed in South America, therefore, is imported, the bulk of it coming from Cardiff and Newcastle. This coal can be landed at the Brazilian and Rio Platte ports at a fairly reasonable figure, but when it is required for the west coast, the almost prohibitive insurance incident to the passage of Cape Horn and the exposure to the deadly "northers" in the unprotected ports of Chile makes it an extremely high-priced article.

The expensiveness of steam-fuel has been the greatest single industrial handicap that the Pacific Coast of South America has had to contend with, yet had the people of that region only awakened to the fact, the best substitute in the world for steam in the capacity of a power generator has been running past their doors ever since there were any doors for the Andean rivers to run past.

It was no thoughtless statement—and, the writer is convinced by considerable observation in various quarters of the world, no exaggerated one—that the natural conditions in Chile for the development of electrical power were more favorable than elsewhere. There are in the eastern half of the continent two waterfalls, both of which are higher and of greater volume than any on the Pacific side of the divide, and located, as each of them is, in a remote and totally unsettled district, their practical usefulness for many years, at least, is largely problematical. In Chile, on the other hand, from the thirtieth parallel (north of which for several hundred miles are only the rainless deserts of the nitrate provinces) south to Cape Horn, there is not a city, town or hamlet that cannot be cheaply and efficiently served with electricity generated in most instances not over ten, and in no case over fifty, miles from its center. In Peru and Ecuador, while the distribution of settlement and the natural advantages are not so favorable as in Chile, the latter are far greater than in many places where water power has displaced steam in generating electricity, and, considering the increasing demand for power in those countries in the face of the high price of coal, it seems inevitable that there must shortly be great development along the same lines now being followed by their progressive southern neighbor.

A Spectacular Development Project.

The most spectacular single power-development project in Chile is that in connection with the great falls of the Rio Laja in the south-central section. The Laja is the main branch of the Biobio, the largest of the southwest coast rivers, and its volume may be roughly estimated at about half that of the Hudson. The falls, which average more than a hundred feet in height, are unfortunately not located within economical transmitting distance of the principal population-center of the country, the district lying between Santiago and Valparaiso and including the large cities and towns of the Aconcagua valley.

Concepcion and its port, Talcahuano, with a combined population in excess of 100,000, and Chillan, with a population of 30,000, are the only important places that will benefit materially by the carrying out of the now well-advanced plans for harnessing the Laja, but the building of numerous industrial establishments at favorable locations on the government railway within a short distance of the falls is definitely assured. It is also planned to operate several divisions of the railway, and their branches, with power from the same source.

If the rich and beautiful Santiago-Valparaiso district will not benefit from the Laja proposition, it may still draw power from half a dozen different sources, any one of which could alone supply its rapidly growing demand for many years to come. The most favorable, and likewise the most advanced, project at this point is that of installing a series of water-driven turbines on the upper portions of the Rio Aconcagua, and its principal branch, the Colorado. The former, as its name would indicate, takes its rise and draws most of its flow from the Pacific watershed of the great 23,500-foot peak of Aconcagua. This famous mountain—in common with others of a chain of peaks so lofty that the average altitude of the continental divide for a distance of several hundred miles in either direction is in the vicinity of 18,000 feet above sea level—except in the most exposed places, carries a perpetual snow-cap which, even at the end of summer, extends for many thousand feet down from its cloud-piercing summit. Fed from such exhaustless founts, the rivers that rise in the higher Andes, irrespective of what the seasons may be in the valleys, flow strongly and constantly throughout the year. Their flow of snow-water is greatest in the hot summer months, but when the winter's cold begins to restrict the supply from this source, the rains of that season come on and keep up the flow until the spring thaw commences.

In installing one of these water-power plants the expense involved may be generally reckoned to be in inverse ratio to the natural fall of the river from which water is taken, the minimum expenditure being where the drop is perpendicular, as at a waterfall. There are few falls of great height on the Aconcagua or Colorado, but above their junction a few miles east of the city of Los Andes, each is so continuous a succession of rapids and cascades that, from bank to bank for miles, their water is as white as the snow from which it comes. The two streams are of about the same volume, but the Colorado has rather the more precipitous course of the two. In twenty-five miles it falls away more than 12,000 feet, while the drop of the Aconcagua is about 8,000 feet in the same distance. There are few points where a fall of several hundred feet cannot be obtained inside of a mile, and the minimum flow of either is sufficient, if utilized at half of the available points, to amply supply the needs of the adjacent territory for the next fifty years.

The companies which hold the concessions for the water power of these streams are Chilean, but their consulting engineers are American, and their machinery will also come from the United States. The first plant built will be in sight of the new transcontinental railway, now almost completed between Valparaiso and Buenos Aires, and it is probable that one of the first uses to which the power is put will be in operating the Chilean Trans-Andine section of this road. Another improvement—long projected, but never carried out on account of the cost of power—that will spring into being with the completion of these plants is the electric road between Valparaiso and Santiago. This will involve a hundred miles of costly construction, but, with cheap power, the heavy expenditure necessary will be fully warranted by the great movement of freight and passengers between the Chilean capital and its principal port. The impulse of cheap electricity for manufacturing plants will be the biggest lift Chilean industry has ever received, and all in all there are not fewer than a million people who will benefit, directly or indirectly, through the development being pushed on the Aconcagua and Colorado.

As stated, there are several perfectly feasible projects for developing power for Santiago and Valparaiso at other points than on the Aconcagua, but as the scheme regarding the latter is already being carried out it would not seem that there would be any reason for doing anything with the other propositions for a good many years.

South from Santiago for several hundred miles—between a low coast-range and the main "backbone" of the Andes—stretches an open series of connected valleys, which, closely settled and intensely cultivated, forms what is generally conceded to be the "garden spot" of South America. Towns of from 5,000 to 30,000 people follow each other in steady succession along a railway line that is already in process of being double-tracked to meet the increase of business. Back of these towns tower the 20,000-foot summits of the mountains, while through, or near, each of them, flows one or more rivers from its source in the exhaustless Andean snows. Not a town of them but has an Aconcagua of its own, and hardly one of them but is doing all it knows how to pave the way for a big power plant of its own. Undoubtedly some of these will be built, notably in such places as the present manufacturing center of Talca, which has 40,000 people and numerous factories of all kinds.

In the south of Chile, where the heavy all-the-year-round rainfall is responsible for rivers of much greater volume than in the north, the possibilities for power development are unlimited; unfortunately, however, on account of the present sparseness of settlement, there would be scant use for electricity at any price. Nevertheless, one notable proposition, that of the fall of the Perihueico, is already under exploitation.

This fall occurs between the lakes of Perihueico and Panguipulli, alongside the pass of San Martin, by which a railroad is now building to connect Chile and Argentina, and, ultimately, the Atlantic and Pacific. These lakes, though but ten miles apart, have a difference in elevation of 1200 feet. The Chilean company building the railroad through the pass will use the power generated at this point to operate its trains, run an extensive system of sawmills and, if practicable, in working a lock that is being constructed as an aid to navigation between two of the remoter lakes.

On the eastern slopes of the Andes conditions for power development are scarcely less favorable than on the western, but, as in southern Chile, there are few places where the settlement is dense enough to warrant the requisite investment of capital. A striking exception occurs in the Argentine province of Mendoza, where the river of that name comes roaring down the Atlantic divide from the summit of the Uspallata pass in fashion similar to that of the Aconcagua on the Pacific side. Most of the Mendoza's water, in fact, comes from the great peak of Aconcagua, and the supply is no less inexhaustible than on the western slope.

The province of Mendoza is rich and populous and, though rainless, has become through irrigation and the scientific cultivation of its rich soil, the greatest vine-growing and wine-making district south of the equator. Last year its output of wine alone was valued at $40,000,000, and a steady increase is expected for many years. The worst drawback the section has had is that of the expensiveness of power for the wineries, due to the high price of coal, a difficulty of which little should be heard after May of next year, the date at which the concessionaries for the water-power rights of the Rio Mendoza must have their first plant in operation.

The two great falls of South America are the Yguazu and the Kaiteur. The former of these is located on the Upper Parana River between Paraguay and Argentina, and the latter on the Potaro, a large branch of the Essequibo, in British Guiana; on the score of grandeur and impressiveness, either is worthy of being ranked with Niagara and Victoria at the head of the list of the great cataracts of the world. Yguazu will average higher than Niagara, and at times probably flows nearly an equal amount of water. In form it is more broken and generally less regular than the great American fall, but makes up for what it loses in this

respect in the wild riot of tropical vegetation that surrounds it. A concession of its power rights on the Argentine side was granted to an English company a little more than a year ago, but nothing of importance has yet been done. To be of value its power must be transmitted to Montevideo, Buenos Aires, and Rosario, and, as each of these cities is approximately 500 miles from the fall itself, it would appear that the time is not quite yet ripe for active operations.

Kaiteur, 300 feet wide, 700 feet in height, and situated within six degress of the equator, is one of the grandest and, at the same time, one of the least known of all the great sights of the world. As reaching it involves the fitting out of an expensive expedition and a continuous up-river trip of 300 miles, with numerous portages at rapids, one is not surprised to learn that less than fifty white men are said to have looked upon it. Though in a straight line this splendid cataract is probably within direct transmitting distance of Georgetown and the big sugar mills along the coast, the general backwardness of the country would lead one to the conclusion that its enormous forces are destined to run to waste for a good many years to come.

There are electrical installations all over Peru which are more or less important. Electricity is used principally for public and private lighting and for application in the mines. Electric street railways have been used for city and inter-urban service only in Lima. As would naturally be supposed, the largest and most important installations are to be found in the neighborhood of Lima. For feeding its distribution system for lighting, power and traction, Lima possesses a number of hydraulic installations, which are probably the most notable in South America.

At present there are two hydro-electric stations and one auxiliary steam station. The first is constructed at the foot of the Andes, and is that of Chosico; it utilizes a fall of forty meters and a flow of five cubic meters per second. The second is at Lima, and utilizes a fall of twenty-five meters. The Chosico station is about forty kilometers from Lima. The water is conducted from a concrete dam constructed 200 meters above the station, by a canal three meters deep and eight meters wide; this canal ends in a reservoir where sand and gravel is allowed to accumulate. The water drives three groups of three-phase generators which produce current at 2300 volts, and the transformers raise the e. m. f. to 33,500 volts. At this e. m. f. energy is transmitted to Lima by two independent lines. The poles are made of white cedar, and are from nine to ten meters long. The central station of Polvora (Lima), which also serves as a sub-station for the Chosico station, is fed by a reservoir having a capacity of 54,000 cubic meters, and through a penstock 600 meters long and 75 centimeters in diameter. In the steam auxiliary plant there is, among others, a Curtis turbine rated at 1000 horsepower; crude petroleum is used as fuel.

There are three sub-stations; one at Legria to feed the Lima-Callao Railway; one at Miraflores to feed the Lima-Chorrillos Railway, and one at Lima for the city railways. At Polvora the e. m. f. is reduced to 10,000 volts; the second transformation reduces it to 2080 volts, and the last to 104 volts, which is the e. m. f. of the distribution system.

Arc lamps in series and incandescent lamps are used for the public lighting in Lima. In private lighting, the flat rate of $1.00 a month for each sixteen candle-power lamp prevails. Previously, for different reasons, people have been more or less opposed to the introduction of the watt-hour meter, but now they are becoming more reasonable. By the meter method, energy is sold at fifteen cents per kilowatt-hour, while the horse-power-month costs from $3 to $4, according to the rating of the installation and the number of hours of use per day.

CONCERNING WOOD PRESERVATIVE.*

By George H. Erich.

The matter of treating all timber in order to preserve its usefulness has been the study of many engineers in the past several years. Particularly has this entered into the field of electricity and to the telephone industry.

There are several methods of treatment, but the most successful is the vacuum or pressure treatment, in which process creosote is employed. Next in importance is the immersion application pertaining to timber being given a bath in impregnating or preserving oils. The third method is the brush treatment, in which process oils are also used.

The vacuum treatment is the most expensive on account of the necessary machinery required, and this method will become popular only where large quantities of timber are to be treated, and it is the intention of owners of such treating plants to sell treated wood. For the ordinary man who has only a limited quantity of poles, ties and cross-arms to treat the bath in impregnating oils is the cheapest and all that is required is a steel tank large enough to take in the size of the timber to be treated. In the case of poles which need only to be treated at the butts a two-coat brush treatment is sufficient, providing the man who handles the brush sees to it that the checks in the pole are filled. It is also well to treat all gains and roofs of poles.

There are many men in the telephone business today who are, no doubt, anxious to find out what a wood preservative really is, and who would think a great deal more of the treatment of their poles and their timber were they made acquainted with the proper facts.

Many men have painted their poles and crossarms with either lead paint or tar, thinking that would preserve them. It does, but only on the outside, for the inside will dry rot and weaken the pole. Applying the paint or tar merely closes the pores of the wood, sealing in all moisture contained in the timber, and as all rot is caused by germs, no matter whether in the wood or anything else which has life, these germs cannot escape, consequently they must die in the heart of the timber, causing the wood to decay to powder.

A wood preservative must be an element which leaves the pores of the wood open, and at the same time penetrates to a considerable depth. If it should not have the power of penetration it will wash off. Lead paints or heavy tars are not a preserver in a true sense. They only preserve the surface of the wood for the time being. Creosote applied in any other manner than through pressure will not penetrate timber, for it will remain on the surface and can be scraped off with a knife or washed off with water. It remains, then, that high boiling oils of great specific gravity and containing less of the volatile oils, and only 2 or 3 per cent of tar acids, are the best and cheapest elements for the preservation of wood. Compounds containing chloride of zinc will preserve for a time, but those compounds having zinc solution would be soluble in water, and would naturally bleach out. Compounds, no matter what their name or brand, should conform to certain specifications and every buyer of wood preservatives should have the manufacturer he buys from supply him with analysis of his goods. This analysis should be compared with the specifications for wood preserver, or carbolinium.

Analyses of various preservatives made by different manufacturers have been made by the engineering department of the American T. & T. Company. Probably no other user has gone so far into the subject, and it is interesting to know that the conclusions of this company require that carbolinium must conform to the following specifications and not contain more than 2 per cent of tar acids:

*Condensed from "Sound Waves."

Specific gravity at 20° C.	1.12
Flashing point	149° C.
Burning point	175° C.
Distillate up to 235° C.	.40%
Loss	.00
Distillate between 235°C. and 300° C.	.10%
Residue	89.6%
No separation of solids from 0° C. to 5° C.	
Tar acids	1.3% to 2%

Besides adhering to the foregoing table of specifications two essentials should be borne in mind, viz.: (1) always ask for wood preserver; (2) carbolinium, the word, is public property.

There are so many questions which can be brought up, as, for instance: The depth of necessary penetration to obtain results; the application of the preserver; the cost of treatment as per tie, pole, or per foot; the length of life obtained by using the article; the danger to persons who are directly applying it; and a hundred others.

As far back in history as can be traced the best known chemists of Europe have maintained that the more of the high boiling oils contained in wood preservation the better the compound.

The best grades of carbolinium contain about 90 per cent of preservative elements, and these grades you should use, for they are the cheapest in the end, and should increase the life of wood at least 100 per cent, no matter in what climate used. In the west and south, and in the tropical countries the life of timber which is subjected to climatic changes is very short, and the men of these districts have been engaged in the treatment of their wood structures for many years.

The price of timber is advancing so rapidly, due to the scarcity of the article, that many northern companies are now treating their poles in order to get longer life out of them, and I dare say that within a few years all persons engaged in the electrical and telephone industries will be applying some meritorious preserver to their timber.

It is a matter of paramount importance in the expense of the maintenance of any plant, and everyone should become familiar with the subject and study it.

The United States Government is interested in the preservation of timber, and I wish to quote a statement by William L. Hall, of the Forest Service. He says: "It is well known that a thorough impregnation with a good grade of creosote will render wood immune to decay for a long term of years, and, judging from the condition of the butts of the poles, after treatment by open tank process and from our knowledge of the antiseptic qualities of the preservative, there can be little doubt as to the securing of a decided increase in life."

The best grades of preservatives are those made in Germany, and these contain the high boiling oils of coal tar, commonly called carbolinium.

According to the greatest authority in the world on the preservation of timber, Samuel B. Boulton, it is the high boiling oils that bring the best results. It makes no difference whether these high boiling oils are in creosote or other products.

It is true that chloride of zinc treatment has brought results, but this was not applied with a brush. The chloride of zinc was a solution of about 5 per cent chloride of zinc and 95 per cent water, and was forced or injected into the timber under pressure. That treatment is commercially known as the Burnettizing process. In high, dry altitudes it has brought very good results on ties, but where the rainfall is of any great consequence it has been found unprofitable. Some of the largest users of that process have discarded it for that reason.

While any article that is a germicide will prevent the rotting of timber it must be borne in mind that the article which will prevent rot or decay the greatest length of time, or the one wherefrom the best results will be derived, is the article which contains the largest amount of high boiling coal tar oils. Therefore, when one is considering the use of a preservative, they should always procure that which shows the least amount of distillate at a temperature up to 300 degrees C. It is just as cheap to apply a good preservative as a poor one, hence you will see the reasons for such precaution.

In the Forest Service circular No. 4, Carl G. Crawford, chief of the office of Wood Preservation, says: "Though the length of time added to the service of poles cannot now be stated, enough is known regarding the value of preservatives as preventives of decay to justify a conclusion as to whether the added life will repay the cost of treatment.

"By the brush method the average cost per pole was about 40 cents, or 29 cents in the case of creosote, of which 7 cents stands for the cost of oil. By the open-tank process the average cost per pole with creosote was 67 cents, of which 22 cents stands for the cost of oil.

"Assuming that the cost of a standard 30-foot pole at the setting hole is $8, and that, untreated, it will last twelve years, the added life necessary to repay the cost of treatment with creosote by the brush method will be about six months and by the open-tank method about one year. A very conservative estimate of the added life by the brush method is thought to be three years, which would mean a great saving. In the tank treatment three times as much oil was absorbed as in the brush treatment, and the penetration was at least three times as great. If it results in prolonging the life of the pole in proportion to the oil absorbed, then it will be a very efficient treatment, and the economy of its use will be very great, not only in comparison with no treatment, but in comparison with the brush treatment."

EDUCATION.

The Board of Directors of the American Institute of Electrical Engineers has authorized the appointment of a committee on education, in accordance with the sentiment expressed at the Niagara Falls Convention. This is the outcome of a feeling that engineering education should profit by closer relations with experienced engineers, who are able and willing to co-operate with the colleges in their efforts to attain the best possible results. Discussions at various conventions have shown that this is feasible, and as representatives of many technical schools who are members of the Institute have attended these gatherings, no doubt some of the ideas brought out have already been put in practice. It appears quite possible that a similar movement might be beneficial in considering the relations between the common schools and the general public. There is a well-founded impression that graduates from all schools are lacking in elementary principles which should be thoroughly grasped before the student enters upon his life work. A few years ago a system of vertical handwriting was introduced in several States, and no serious objection raised against it until business experience demonstrated that it was not suitable for commercial purposes. It was too slow, it lacked individuality, and did not harmonize with existing practice. Possibly if no other style had existed, there would have been no objection to it, but in at least some cases the innovation was abandoned. Possibly too much is expected of teachers. The character of the raw material which they are expected to mould, is frequently beyond the capacity of human effort.

CURRENT COMMENT

It is claimed that the consumption of lubricating oils can be reduced 25 per cent by the use of defloculated graphite suspended in oil.

It is claimed that a copper wire enclosed in a fine tube of enamel, the two being arranged in the form of a ribbon, can be used as a substitute for platinum wire for the leading-in wires of incandescent lamps. The coefficient of expansion of the alloy is said to be the same as that of glass.

Grass along the track and right of way of the Northern Texas Traction Company for thirty-five miles between Fort Worth and Dallas is now removed by an oil burner mounted on a flat car run slowly over the track. Crude oil is used as fuel. The outfit consists of a motor-driven air compressor, two air reservoirs, three oil reservoirs, and four burners, together with the necessary valves and fittings.

The American Railway Association has appointed a committee to establish a standard location for third-rail working conductors on electrically operated railways for the purpose of facilitating interchange of equipment, electric or otherwise, between different roads. As the third-rail must be placed adjacent to the track rails, the question of interference with existing permanent way structures and with existing rolling stock becomes of importance. The two types in most extensive use are the "top contact" and the "under contact."

The Eiffel Tower has a mast wire hanging from the summit for use as a wireless telegraph station. Messages can be sent as far as Bizerta, the French military port not far from Tunis. Signals were also received at the port of Casablanca in Morocco, during the recent troubles in that region, and the vessels of the fleet in the different Mediterranean ports can now communicate with Paris. It is proposed to increase the power of the Eiffel Tower plant and to provide it with apparatus of a much larger capacity, so as to increase its range of action.

The War and Navy departments will co-operate in maintaining wireless communication between Nome and St. Michael and Seattle and San Francisco. Next year the Signal Corps of the army, which already has wireless stations in the Alaskan cities, will establish one at Fort Gibbon, which will be in touch with a station to be erected by the navy at Valdez. The navy has several stations in Alaska. Steel towers 175 feet high are to be erected at Fairbanks and Circle, Alaska, to carry wireless telegraph instruments. These towers will be 140 miles apart, and regular communication is to be maintained between them.

Recent tests by the Forest Service show longleaf pine to be the strongest and stiffest of the timbers, with Douglas fir a close second. Western hemlock, loblolly pine, tamarack and Norway pine follow in the order given. Much of the information hitherto available concerning the strength of timber has been secured from tests of small pieces without defects. This can not safely be assumed to hold good for large-sized timbers as found on the market, since these commonly contain such defects as checks, knots, cross grain, etc. The location of the defects varies the extent to which they lessen its strength; and the proportion of heart and sap wood, and the state of seasoning, must also be considered. Circular 115 of the Forest Service, just issued, which gives the results of tests conducted during the past four years, will be mailed upon applicatoin to the Forester, Forest Service, Washington, D. C.

At a recent meeting of the electrical section of the Western Society of Engineers, H. V. Allen showed that the predominating color of the enclosed arc lamp using 110 volts with clear globes is bluish white, which is modified by an opal globe and diffuser to white, with three and one-fourth amperes, 140 volts direct current, the violet color is beyond correction. The Nernst lamp gives a pale lemon-yellow with a new glower and a deep lemon-yellow with a seasoned glower. The new incandescent filament light gives a yellow color, the seasoned pale orange yellow. A greenish white light is given from new and a greenish yellow from seasoned Welsbach and vapor hydro-carbon lamps. The ordinary gas flame gives a reddish yellow light.

An electric clock system is to be installed in the new office building for the House of Representatives at Washington, D. C. It will consist of one master clock, capable of driving 500 units and 422 secondary clocks. The master clock is to be self-winding and will keep the dials of the others synchronized at all times, so that they will require neither winding nor setting.

An electric steel furnace installation company has been formed in Berlin under the title of the Gesellschaft fur Elektrostahlanlagen. As founders are the Eich Hutten Verein, Gallais-Metz & Co., of Dommeldingen, Consul P. Gredt, of Luxemburg, the Metallurgiska Aktiebolaget, of Stockholm, the Rochling Iron and Steel Works, of Volklingen, on the Saar, and the Siemens and Halske Co., of Berlin. The object of the company is the promotion of the industrial utilization of furnaces for the production of iron, steel and ferro-alloys, and particularly the induction type of furnace of the Kjellin-Rochling-Rodenhauser combination, and to extend the use of the furnaces in all countries other than Great Britain and British colonies, the United States, and Norway and Sweden. The granting of licenses in these countries lies in the hands of the Grondal Kjellin Co., Ltd., of London, the American Electric Furnace Co., Ltd., of New York, and the Metallurgiska Aktiebolaget, of Stockholm. Herr Viktor Engelhardt, of the Berlin Siemens & Halske Co., has been appointed manager of the new company. A second undertaking to which attention may be drawn is that of the steel works of R. Linderberg, at Remscheid, where electrical furnaces on the Heroult-Lindenberg system are in operation. This company has just declared a dividend of 9 per cent for 1906-7 on a paid up capital of £112,500, as compared with 9 per cent on £40,000, and 4 per cent on £25,000, in the preceding year. An exclusive license for the province of Silesia has been granted to the Bismark Ironworks, and the starting of various installations on this method will take place in a few months in Austria-Hungary and Switzerland, whilst plant is in course of erection at five steel works in the United States.

The JOURNAL of ELECTRICITY POWER AND GAS
WITH WHICH IS INCORPORATED
The Engineers', Architects' and Builders' News

Published Weekly by
THE TECHNICAL PUBLISHING COMPANY
SUCCESSORS TO
The Journal of Electricity Publishing Company
304 Atlas Building, San Francisco.

Yearly subscription, $2.50. Single copies, 10 cts. Back numbers prior to the current month, 25 cts. Foreign subscription, $4.00.
Subscriptions cannot be begun with back numbers.
Manuscripts submitted must be accompanied by postage to insure return.

Address all communications and make all remittances payable to The Technical Publishing Company.

Los Angeles Office Wm. J. Gracey 525 South Spring St.

Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," with which is incorporated "The Engineers', Architects' and Builders' News."
Entered as second-class matter at the San Francisco Post Office, August 15, 1899.
Entered as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.

VOL. XIX NOVEMBER 23, 1907 No. 21

EDITORIAL.

TELEPHONE ENGINEERING.

Notwithstanding the fact that the telephone was invented in 1876, nearly thirty-one years ago, yet the telephone instrument in use today is practically the same as when first invented. It is probably within the memory of many that when the telephone was first introduced, small crude models were constructed which could be used for the transmission of speech very satisfactorily. Two wooden boxes, over the ends of which were placed pieces of tin, as diaphragms, each box containing a coil and a small permanent magnet, when properly electrically connected, could be used for the transmission of speech, and the results were as satisfactory as is possible over any telephone today.

The telephone instrument consists essentially of a diaphragm, magnet and a coil. While it is true that the telephone instrument has of itself been improved but little, the real problems of the telephone engineer are with the line. With alternating current for power and light the circuits are used to transmit energy at a fixed frequency. With telephone lines we are dealing with the simultaneous transmission of a number of alternating currents of different frequencies. It is not difficult to send these currents in at one end, but it is extremely difficult to receive them at the other end in anything like their original form. The different currents, with their widely different frequencies, arrive at the receiving station with the wrong amplitude and in the wrong phase relation.

The study of telephonic transmission in a scientific manner has advanced remarkably during the past few years. The necessity for increasing the distance over which commercial speech is possible, and also the realization of the large expenditures involved in line construction, are undoubtedly responsible for the extraordinary progress in telephone extensions. Engineers in general are especially indebted to Pupin, Kennelly, and Heavyside, for investigations upon the theoretical side. Recently there has been presented before the Institution of Electrical Engineers, a most valuable paper upon "Telephonic Transmission Measurements," by Messrs. Cohen and Shepherd, in which they have used the oscillograph to determine not only the frequency but the wave form of telephone currents.

In order to utilize, for practical purposes, the known laws governing the transmission of telephone currents, it is, of course, necessary to have accurate quantitative information regarding the various factors concerned. Unfortunately, but a few of the many factors are known. As an illustration, the average and the highest important frequencies to be found in telephone speech waves have, in the past, been merely approximated, and, naturally, as a result, little information is available regarding other factors which depend upon them.

The inductance and electrostatic capacity of telephone lines affect in a marked degree the transmission of telephone currents, and the long telephone lines in use at the present time would give most unsatisfactory results if data were not available in order to accurately compute the proper amount of impedence to artificially use in such lines.

The results of experiments made upon artificial lines, as set forth in the above mentioned paper, indicate that the fundamental frequency of telephone currents varies somewhere between 800 and 3,000 cycles per second. It was found, for instance, that a note sung by a girl in a high tone into the telephone, produced currents, which, when recorded by the use of the oscillograph and a falling photographic plate, represented a frequency of 3,000 cycles per second.

However, it would seem that the highest indispensable frequency lies somewhere between 800 and 1,200 cycles per second.

In order to carry out some of the experiments, a small inductor alternator was built, having an armature built up of ordinary slotted stampings, the frequency of the current from this machine being 800 cycles per second, with a speed of 960 revolutions per minute. With this machine the authors of the paper succeeded in producing practically true sine waves.

The importance of such investigations can be easily understood when the enormous investment required in telephone lines is considered. Telephone engineers at the present time, with all the data available, seem unable to materially reduce the excessive cost of such lines. To those who superficially criti-

cize telephone companies on account of excessive rates, it will be, perhaps, interesting for them to know that when a subscriber has the exclusive use of a line between London and Glasgow, he is, for the time being, using a circuit containing 300 tons of copper, which, at the present date, represents approximately $150,000. Naturally, the total necessary investment in the system is considerably higher than the above figure.

Certainly the time has come for telephony to receive the systematic experimental investigation which has been so successful in other lines of electrical engineering, notably the long distance transmission of power at excessively high voltages. Although the currents in use are of small magnitude, the subject is an exceedingly large one, and the conditions are generally complex and variable. The interference of other circuits carrying electric currents will, in many cases, tend to nullify the most accurate measurements which can be made upon telephone circuits.

Again, the literature dealing with the experimental side of telephone engineering is exceedingly meagre. Prof. Kennelly has probably done more in a practical way to solve the many problems connected with telephone lines than any other engineer. His investigations, however, have been, for the most part, purely mathematical and theoretical, rather than experimental.

This field of experimental investigation is certainly an attractive one, as recent experiments with telephone lines seem to show that the high standards originally supposed to be necessary for the successful transmission of speech are in reality unnecessary.

Distinct articulation is, of course, the most important feature of any telephone system, and such distinct articulation cannot be produced unless frequencies are maintained in their original form. However, it has been found possible to flatten out the waves of the telephone alternating currents, and yet transmit fairly satisfactorily good commercial speech. This is really not so very extraordinary, because the same thing happens in ordinary air transmission. Speech is frequently greatly distorted, not only by the speaker, but by the interference of various objects in the line of the transmission of speech through air.

At the present day it would seem that, although there are great advances to be made in the transmission of electrical energy for power and light, yet the use of electricity for the transmission of speech or signals has a much more attractive future. The commercial telephone can undoubtedly be used for much greater distances than is common at the present time, and, notwithstanding the practical operation and the wonderful strides which have been made in wireless transmission of speech and signals, it is questionable whether any field of electrical experiment has such a direct practical bearing upon every-day life as the unlimited extension of the telephone in its present form and as now used by everyone.

IMPORTANT NOTICE.

For the purpose of facilitating the disposition of a matter of great interest to hydro-electric companies, and to be sure that we have at our disposal the proper names of not only the corporations, but their presidents and secretaries as well, we would like to receive at the very earliest convenience from all the water power companies operating west of the Rocky Mountains, their proper corporate name, together with the names of their respective presidents and secretaries.

The reason for asking for this information is of vital importance to every hydro-electric power company throughout the West, and an immediate reply is urgently requested. Legislation at Washington at this next session of Congress will undoubtedly make it advisable for an organization of your companies to be formed. Personal letters will be sent you upon receipt of the above information.

JOURNAL OF ELECTRICITY, POWER & GAS.

PERSONAL.

Jos. T. Wolfe, chief engineer of the Tonopah Mining Co. of Tonopah, Nevada, is in San Francisco.

H. B. Kirkland representing the National Metal Moulding Co. of Pittsburg, is again in San Francisco after a pleasant trip South.

J. M. Halladay, formerly with the Washington Water Power Company, has been appointed inspector of gas and electricity in Spokane, Wash.

W. T. Brown of Philadelphia, head electrician for the Pennsylvania Railroad, who installed the lighting and electric appliances in the great Pennsylvania station at Philadelphia, is in San Francisco.

A number of old friends in the electrical supply business had a very pleasant informal lunch, Friday, November 15th, at the Cafe Francisco. Those present included E. W. Rockafellow, supply sales manager of the Western Electric Co.; H. B. Kirkland, of the National Metal Molding Company of Pittsburg; E. M. Scribner, president of the California Electrical Works; R. E. Heine, of D. H. Burnham & Company, and John R. Cole. This enjoyable affair was given at the conclusion of the successful visit to San Francisco by Mr. Rockafellow and Mr. Kirkland, who have gone to Los Angeles and Catalina Island together with F. F. Skeele, representing Crouse-Hinds Electrical Company, who was prevented by sickness from attending the lunch. This trio of representative men in the electrical trade can do incalculable service toward maintaining the credit of the Pacific Coast in the course of their extensive travels throughout the country, as the result of their pleasant and profitable visit here.

TRADE CATALOGUES.

The Benjamin Electric Manufacturing Company, of Chicago, Ill., send a supplementary bulletin containing additions and changes affecting catalogues B-17 and B-17A, being devoted mainly to wireless clusters and lighting specialties.

Mathias Klein & Sons, 87 and 89 West Van Buren Street, Chicago, Ill., have issued a price list illustrating "Gem" Wire and Cable Grip, which is made in three different styles—single eye, double eye, and double eye split. The first type is used for work requiring simple pulling, the second for tailing in and pulling out cable already installed, giving a grip at any point when slipped over the end, and the third in cases where the grip cannot be applied at the end, and a hold is desired at an intermediate point.

LOCAL STOCKS AND BONDS

Furnished by Courtesy San Francisco Stock and Bond Exchange.

Outstanding	INTEREST	MISCELLANEOUS BONDS.	NOV. 14		NOV. 15		NOV. 16		NOV. 18		NOV. 19		NOV. 20	
			Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
1,532,000	F & A	Associated Oil Co. 5%	.....	80	.....	80	73	.....	73	.....	73	.....	73	.....
2,250,000	M & S	Bay Counties Power Co. 5%	92	.....	92	.....	92	.....	92	.....	92	.....	.....	94
1,000,000	F & A	Cal. Central Gas & El. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	98
9,600,000	M & S	Cal. Gas & El. Gen. M. & C. T. 5%	69	.....	68¾	.....	.....	70	.....	70	.....	70	.....	70
900,000	J & J	California St. Cable Co. 5%	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½	.....	102
2,000,000	J & J	Contra Costa Water Co. 5%	.....	100½	.....	100½	.....	100½	.....	100½	.....	100½	.....	100¼
1,000,000	J & J	do do Gen. Mtg. 5%	.....	90	.....	90	.....	90	.....	90	.....	90	.....	90
623,000	F M A N	Edison Light & Power 6%	109	.....	109	.....	109	.....	.....	108	.....	107	.....	107
650,000	M & S	Ferries & Cliff Ho. Ry. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
671,000	A & O	Geary St. Ry. 5%	50	80	50	80	50	80	.....	75	.....	75	49½	65
610,000	M & N	Honolulu R. T. & L. Co. 6%	100	105	100	105	100	105	100	105	100	105	100	105
300,000	A & O	Lake Tahoe Ry. & T. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
500,000	J & J	Los Angeles Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
1,300,000	J & J	Los Angeles Gas & Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
5,000,000	A & O	Los Angeles Ry. 5%	.....	107½	.....	107	.....	107	.....	107	.....	107	.....	107
1,000,000	A & O	Los Angele: Lighting Gd. 5%	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½	.....	101
1,500,000	A & O	Los Angeles Pac. R. R., 1st Con. Mtg. 5%	.....	101	.....	101	.....	101	.....	101	.....	101	.....	100½
3,030,000	M & S	L. A. Pac. R. R. of Cal. 5%	.....	98	.....	98	.....	98	.....	98	.....	98	.....	98
3,000,000	J & J	Market Street Cab'e 6%	.....	106	.....	106	.....	106	.....	106	.....	106	.....	106
5,141,000	M & S	do Ry. 1st Cons. Mtg. 5%	.....	101	.....	101	.....	101	.....	100½	.....	100½	.....	100½
100,000	A & O	Mill Valley & Mt. Tamalpais S.Ry.5%	100	.....	100	.....	100	.....	100	.....	100	.....	100	.....
4,751,000	A & O	Northern Ry. Co. of (Cal.) 5%	108	108¼	.....	108¼	.....	108¼	.....	108¼	.....	108¼	.....	108
1,498,000	J & J	North Pacific Coast R. R. 5%	.....	100¼	99¾	.....	99¾	.....	99¾	.....	99¾	.....	99¾	.....
1,074,000	J & D	Northern Cal. Railway 5%	105	.....	105	.....	105	.....	105	.....	105	.....	105	.....
980,000	J & D	Northern Cal. Power Co. 5%	.....	100	.....	97½	.....	95	.....	95	.....	95	.....	95
6,000,000	A & O	Northern Electric Co. 5%	.....	99	.....	99	.....	99	.....	99	.....	99	.....	99
1,000,000	M & S	Oakland Gas Light and H. 5%	101½	105	101½	105	101½	105	101½	105	101½	105	101½	105
1,374,000	J & J	Oakland Transit Co. 6%	.....	110	.....	110	.....	110	.....	110	.....	109½	.....	109½
1,600,000	J & J	Oakland Transit 5%	101½	.....	101½	.....	101½	.....	.....	.....	.....	101	.....	100½
1,326,000	J & J	Oakland Transit Con. 5%	.....	100	.....	100	.....	99½	.....	100	.....	100	.....	100
7,000,000	J & J	Oakland Traction Con. 5%	.....	98	.....	98	.....	98	.....	98	.....	98	.....	97½
1,500,000	J & J	Oakland Water Co. gtd. 5%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
2,000,000	A & O	Omnibus Cable Ry. 6%	.....	111	.....	111	.....	111	.....	111	.....	111	.....	111
1,149,000	S D M J	Pacific Gas Imp. 4%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
8,494,000	J & J	Pacific Electric Ry. Co. 5%	.....	101½	.....	101½	.....	101½	.....	101	.....	101½	.....	101½
4,491,000	J & J	Pacific Light & Power Co. 5%	.....	97½	.....	97½	.....	97½	.....	97½	.....	97½	.....	97½
3,000,000	J & J	Pacific Tel. & Tel. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
350,000	J & J	Park & Cliff House Ry. 6%	.....	104	.....	104	.....	104	.....	104	.....	104	.....	104
250,000	J & J	Park & Ocean R. R. 6%	.....	104	.....	104	.....	104	.....	104	.....	104	.....	104
700,000	M & S	Powell Street Railway 6%	.....	106½	.....	106½	.....	106½	.....	106½	.....	106½	.....	106½
2,500,000	M & N	Sacramento Elec. Gas & Ry. 5%	90¾	93	.....	93½	.....	92½	.....	91½	.....	92½	.....	92½
6,000,000	A & O	S. F. & S. J. Valley Ry. 5%	.....	.....	.....	.....	.....	.....	.....	109	.....	109	.....	109
3,000,000	J & J	S. F., Oak. & San Jose Ry. 5%	99½	.....	99½	.....	99½	.....	99½	.....	99½	.....	.....	100½
1,500,000	J & J	do do 2d Mtg. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,500,000	A & O	S. J. & S. Clara Co. R. R. 4½%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
642,000	A & O	Sierra Ry. of Cal. 6%	.....	105	.....	105	.....	105	.....	105	.....	105	.....	105
6,000,000	J & J	S. P. R. R. of Arizona 6% (1909)	100¾	.....	100¾	.....	.....	101½	.....	101½	.....	101¼	.....	101¼
4,000,000	J & J	do do do (1910)	.....	102	.....	102	.....	102½	.....	102½	.....	102	.....	102
5,116,000	A & O	S. P. R. R. of Cal. 6% (1912)	102	.....	102	.....	102	.....	102	.....	102	.....	102	.....
4,127,500	M & N	S. P. R. R. of Cal., 1st c. gtd. 5%	105	.....	105	.....	105	.....	105	.....	105	.....	105	.....
3,533,000	A & O	S. P. Branch Ry. of Cal., 6%	.....	122¼	115	122½	117	121	115	121	116½	.....	117	121
11,178,000	J & J	S. P. R. R. Co., 1st Ref'd'g. 4%	84¾	86	84¾	86	84¾	86	84½	.....	84½	.....	83¾	84¼
17,500,000	J & D	Spring Valley Water Co. Gen. Mtg. 4%	.....	85	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
300,000	M & S	Stockton Gas & Elec. Co. 6%	.....	105	.....	105	.....	105	.....	105	.....	105	.....	105
2,000,000	J & J	United Gas & Elec. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20,000,000	A & O	United R. R. of S. F. 4%	.....	62½	.....	62½	.....	62½	60	62½	60	62	60	62
2,500,000	M & N	Valleys Counties Power Co. 5%	.....	92½	.....	92½	.....	92½	.....	92½	.....	92½	.....	92½
		Water Stocks.												
		Contra Costa	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6,000	Quarterly	Marin County	45	.....	45	.....	45	.....	45	.....	45	.....	45	.....
280,000	.....	Spring Valley Water Co.	20¼	21	20	20½	20	20½	20	.....	20	.....	20	.....
		Gas and Electric Stocks.												
37,500	.....	Martel Power Co.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9,340	.....	Mutual Electric Light Co. (Ctfs.)	4½	.....	4½	.....	4½	.....	4½	.....	4½	.....	4½	.....
37,336	.....	do (Extended Ctfs.)	.....	9¾	.....	9¾	8¼	9¾	.....	9¾	.....	9¾	.....	9¾
40,000	Monthly	Pacific Lighting Co.	65	.....	65	.....	65	.....	65	.....	65	.....	65	.....
12,000	.....	Stockton Gas & Elec. Co.	52	.....	52	.....	52	.....	52	.....	52	.....	52	.....
		Street Railroad Stocks.												
10,000	.....	California	.....	135	.....	135	.....	135	.....	135	.....	135	.....	135
10,000	.....	Geary	.....	35	.....	35	.....	35	.....	35	.....	35	.....	35
10,000	.....	Presidio	.....	25	.....	25	.....	25	.....	25	.....	25	.....	25
	Semi-an.	Associated Oil Co.	23¼	.....	23¼	.....	23½	.....	24	25	25¾	.....	24¾	26
1,625	Quarterly	Mill Valley & Mt. Tamalpais S. Ry.	110	.....	110	.....	110	.....	110	.....	110	.....	110	.....
180,000	Quarterly	Pac. Tel. & Tel. Co. (Pfd.)	.....	78	.....	80	.....	80	70	75	.....	77½	.....	75
180,000	.....	Pac. Tel. & Tel. Co. (Common)	.....	11	.....	10½	.....	10½	.....	10½	.....	10½	.....	10½

REMOVAL NOTICE.

This notice is so suggestive of the difficulties under which the merchants of San Francisco have been working that we publish it in full:

AT LAST our new quarters at 117-119-121 New Montgomery Street have been completed, after waiting just one year from the date it was agreed we should occupy them.

On Monday, November 18th, we expect to be fairly settled and thereafter we promise all of our friends and customers our motto, "Prompt Deliveries," will be lived up to.

Without making any excuses for ourselves, we want to ask the pardon of our customers for the many inconveniences and errors which we have subjected them to from our old congested warehouse store, and to express our appreciation of the many favors received from you in the past.

We now assure you that in the future no effort will be spared to make our service perfect; we assure you prompt delivery, best quality of goods, correct prices and courteous treatment.

We are extending an invitation to all purchasers of electrical supplies and machinery to call upon us, whether purchasing or not. We want you to come and inspect our quarters and facilities for handling your account.

We remain,

Very truly yours,
STANDARD ELECTRICAL WORKS,
H. C. Thaxter, Mgr.

P. S.—We have at last been able to get two main line telephones, numbers Kearny 1077 and Kearny 1078.

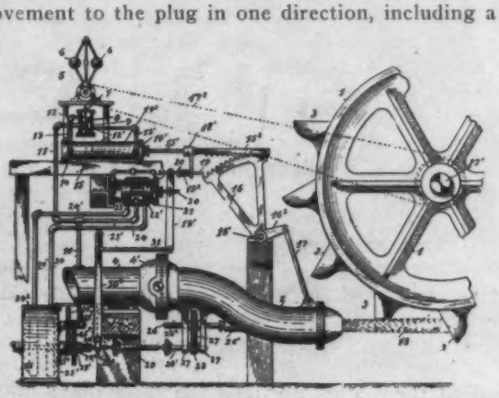
PATENTS

Electric, Gas and Water.

Specially reported for the Journal of Electricity, Power and Gas.

REGULATING MEANS FOR WATER-WHEEL NOZZLES. 870,291. George J. Henry, Jr., San Francisco, Cal., assignor of one-half to The Pelton Water Wheel Company, San Francisco, Cal.

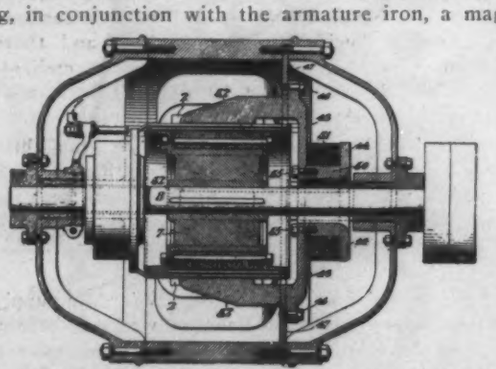
In a hydraulic regulating means, the combination with the hydraulic motor, of a governor, a nozzle, a plug for regulating the outlet area of the nozzle, means for imparting movement to the plug in one direction, including a shaft



connecting with the plug, and a drive wheel connected to the shaft, and means for imparting reverse movement to the plug, including a sleeve mounted upon the shaft, a drive wheel carried by the sleeve, and means for connecting the sleeve to the shaft, a lever connected with the shaft and a connected supplemental lever operatively associated with the governor, whereby the operation of the plug is regulated by the movement of the governor.

DYNAMO-ELECTRIC MACHINE. 870,313. Mathias Pfatischer, Philadelphia, Pa., assignor to Electro Dynamic Company, New York, N. Y.

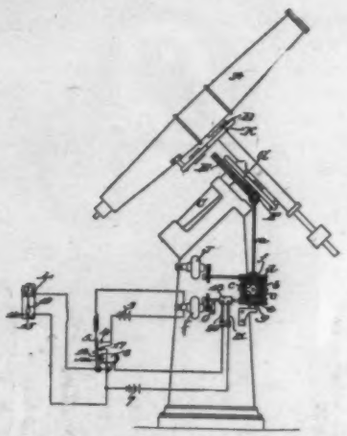
In a direct current shunt wound motor, the combination with an armature; of a field magnet frame provided with main polar projections; auxiliary polar projections of different cross sectional area, said auxiliary polar projections forming, in conjunction with the armature iron, a magnetic



circuit independent of that of the main polar projections; a coil common to said auxiliary poles disposed in axial alignment with the armature; means connecting main coils in shunt relation to the armature windings; means connecting auxiliary coil in series relation to the armature windings; and, means arranged to adjustably vary the strength of the current in shunt coils, independently of series coil, substantially as set forth.

APPARATUS FOR SYNCHRONIZING MOTORS. 870,505. Willard P. Gerrish, Cambridge, Mass., assignor of one-half to The Alvan Clark & Sons Corporation, Cambridge, Mass.

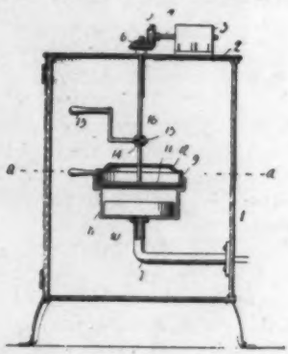
An apparatus for synchronizing a motor, having, in combination, a speed controlling electric circuit adapted to be changed from a condition in which the speed of the mo-



tor is accelerated to a condition in which the speed of the motor is retarded, means for placing the circuit in one of conditions at regular intervals, means controlled by the motor for restoring the circuit to the other condition during each interval, and means for retaining the circuit in last mentioned condition during the remainder of the interval while permitting a change to the other condition.

ELECTRIC POPCORN-MACHINE. 870,155. William H. Bean, Gadsden, Ala.

In a machine of the class described, a casing, a hollow bracket therein attached to one side thereof, a rack on the upper end of said bracket, an electric heater in the lower portion of said rack and having feed wires extending



through said hollow bracket, a pan in the upper portion of the rack and removable therefrom, a motor on the casing, a vertical shaft geared to said motor and having a stirrer to operate in the pan, means to raise and lower said shaft, and a cover for the pan, having an opening through which said shaft extends, and movable vertically on said shaft.

ELECTRIC FURNACE. 865,016. Walter G. Clark, New York, N. Y., assignor to Electric Furnace Company, Portland, Me.

An electric furnace having its walls of conducting material of relatively low resistance, and an internal heater or electrode arranged to contact at its lower end with the furnace walls, and being of less resistance at its end portions than at its intermediate portions and means for elevating the electrode.

INDUSTRIAL

A MODEL ELECTRIC BAKERY.

By Chas. B. Davis, Mgr. General Elec. Co.'s Boston Office.

The Ferguson Bakery Company's plant, located in Boston, presents an interesting and inviting up-to-date electrically equipped bakery. By the use of individual motor drive there is an economy of space, and the machines are located in that part of the room where they can be worked to best advantage and out of the way of trucks used for conveying the cooked food.

The running of quarter turn and long straight belts is eliminated; as is well known such belts running close to and

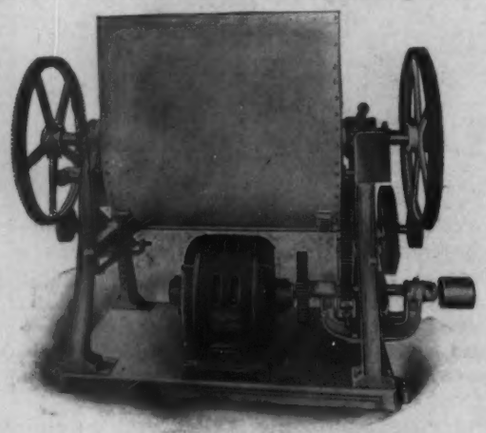


FIG. 1. DAY DOUGH MIXER

parallel to the floor above will collect dust even though it is but little that sifts from the cracks above, and when the belt is set in motion this dust flies into the air and settles on the food below.

Not many years ago this business was started by two Ferguson Brothers in a small shop near the present bakery, all the work being done by hand; today this bakery is foremost in New England.

The small shop where the business originated soon became inadequate for their output, and a new building was constructed where the business could be taken care of. The power for driving the machinery in this building was derived from a steam engine which ran long lines of shafting with belts that ran in every conceivable direction; by this method of drive oil had to be freely used on the many bearings, and these were often so situated that it was only with untiring precaution that oil did not do serious damage by getting into the flour or dough, and again the flour would stick to the belts and cause slipping, and if a belt came off considerable time was lost and the workman was obliged to wash his hands before he could resume his work with the flour.

This method of drive was the best of its kind at that time, but even at its best it was none too good.

The present bakery was to be enlarged, but then came the problem of how to drive the machinery, which was located on the different floors and in the adjoining building.

After careful study and investigation it was decided to adopt the electric drive, which at this time was coming into prominence.

By many this was thought to be a serious undertaking, as all the present shafting, belts and pulleys which could not be used had to be sold as second-hand, at whatever they could get, or else sold as scrap, but the owners were shrewd, and saw that the saving in coal would in a few years not only pay for the scrapped material, but would save money.

Because by the old method of drive in order to work one department overtime it was necessary to run the entire plant where considerable useless energy was consumed in driving the idle shafting, which was often badly out of alignment; of course, this was very hard to observe, and often never detected until a hot box was the result. With the individual drive it is only necessary to run the one machine, which is to do the work, and should the workman wish to do other work he stops this machine by simply pulling out the line switch, and this unnecessary waste of energy driving an idle machine is saved. These motors running from the Edison circuits are each equipped with a recording wattmeter. Now we will suppose that after running one of these motors several months it is noticed that the power taken from the line is gradually increasing month after month, yet the motor is doing the same amount of work and running the same number of hours per day, our first thought would be the alignment of our shafting, and without doubt we would be correct. This poor alignment can immediately be remedied, but in the case of the steam engine drive this loss went on for month after month, yes, year after year, and was never detected unless a hot box or break down occurred—all the time the coal consumption is growing larger and the owner's pocket book shrinking.

The present installation consists of a 100-kilowatt direct current generator, which lights the building and supplies power to some of the motors.

Most of the motors are now run from the Edison 220-volt, alternating current circuits, and I dare say in due time all the direct current motors will be superseded by the three-phase motors which will run from the Edison circuits.

These motors now installed run either individual machines on a short line of shafting, and this shafting only used where it is a good safe working distance from the floor or dough whereby all chance of dirt getting into the flour is eliminated.

The flour which is used is shipped by bag in car load lots and carried from the cars to the bakery by teams; it is then unloaded and conveyed by an electric elevator, driven by an I-12-25 horsepower 600 revolution per minute induction motor, to the top floor of the building and there stored; as the flour is needed it is emptied from the bags into the bins where it is blended, and from there it is carried by an endless chain of buckets to the screener and thoroughly sifted, from here it is again carried by an endless chain of buckets and deposited in a large bin directly above the dough mixers on the floor below.

After a bag has been emptied it is run through a cleaner. This cleaner is nothing more than a large box with a paddle wheel inside, the paddles simply beat the flour from the bag, and this waste flour is sold to foundries where it is mixed with clay and molasses for making the moulds.

On the second floor and directly under the supply bins, are the scales so that the flour is weighed before it is emptied into the mixer. There are three mixers each capable of holding five barrels of flour at one time. Each of these is direct connected to a 20-horsepower induction motor. The average daily output from these mixers is about 20,000 lbs. Fig. 1 shows a General Electric three-phase motor direct connected to a J. H. Day dough mixer.

After the dough is kneaded it is then removed and put in large trays where it is allowed to stand three or four hours to rise. The next process is to cut this dough

into loaf size; this is done by a loaf cutting machine which is run by a small motor. By this machine any size of loaf can be cut.

The chunks of dough are next placed in the shaping machine (Fig. 4) and moulded into the loaf shape. This machine is direct driven by a CE-4-19 horsepower 635 direct current motor.

Two other small shaping machines are used there, being run from a short shaft driven by a CE-4-10 horsepower 635 direct current motor. From these machines, any desired shape of loaf can be obtained. After the dough is made into loaf form, it is placed in the baking tins and taken to the ovens on the floor below where it is baked and from this floor it is then taken to the next floor and made ready for shipment.

The temperature of the mixing room is maintained at 80 degrees F. and in each end of the room are placed recording thermometers, and by referring to these charts one can at a glance see whether or not the room temperature has been kept constant.

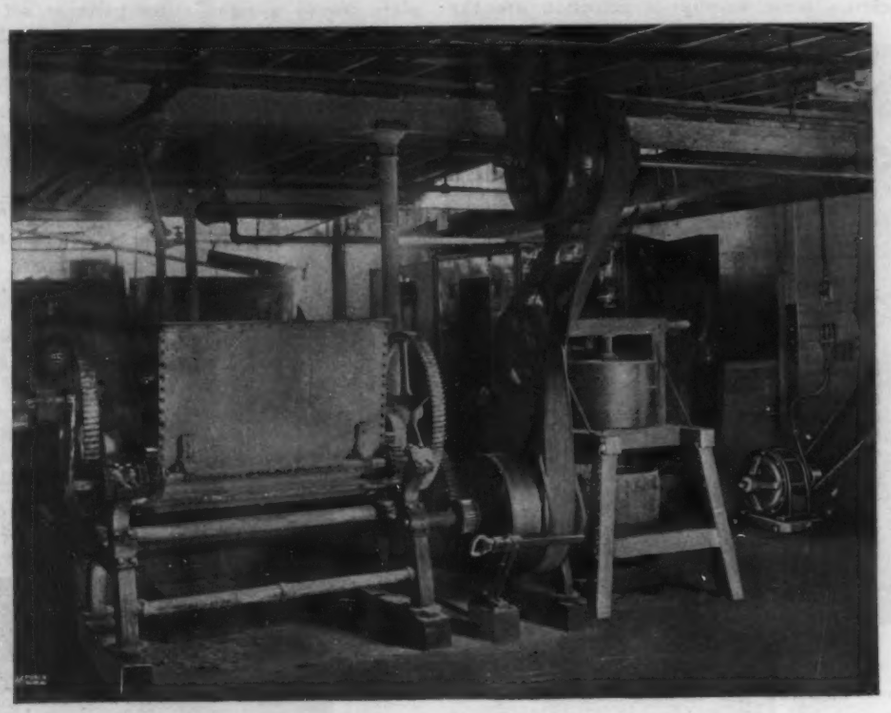


FIG. 2. BROWN BREAD ROOM

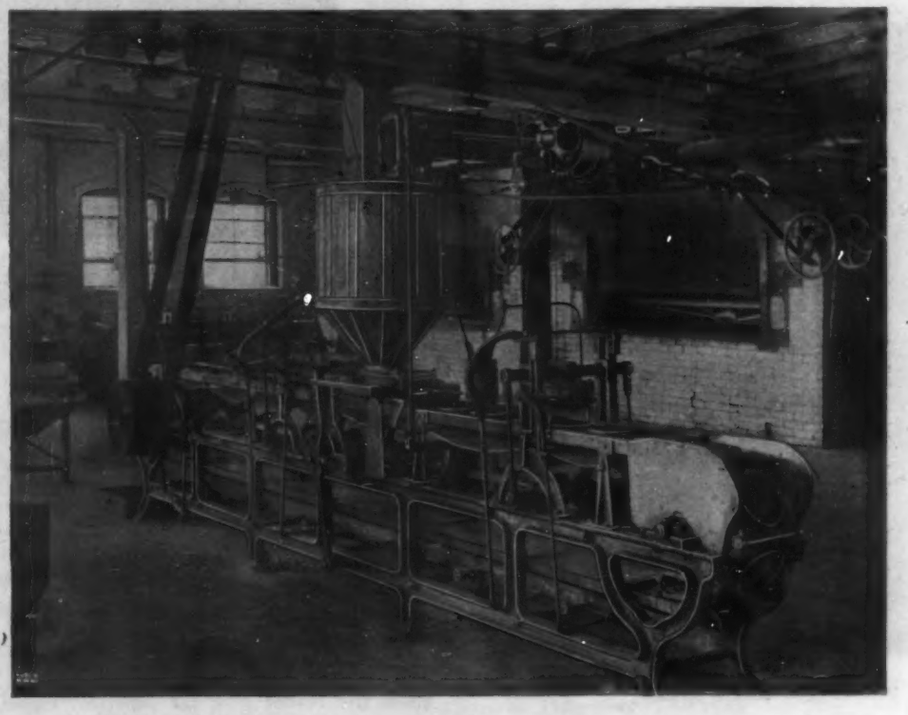


FIG. 3. PIE MACHINE

The pie and cake rooms which are in the adjoining building are worthy of special attention, because of their cleanliness and economical method of making pies or cakes. By the use of several electrically driven machines the work

can be done in that part of the room near the windows, where the best results may be obtained by reason of the good light, fresh air and distance from the ovens which are in the same room.

The two machines most worthy of attention are the

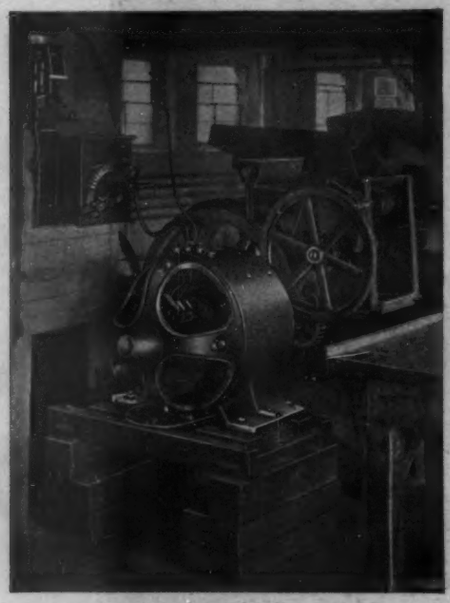


FIG. 4. DOUGH SHAPER

small dough mixer and the pie making machine. The former (Fig. 5) is built by the J. H. Day Co., and is driven by the new type riveted frame 2 horsepower General Electric induction motor. This machine is capable of mixing one barrel of flour at a time.

The whole outfit is finished in white enamel paint and makes a very unique appearing set.

FIG. 5. PIE DOUGH MIXER

After this dough is kneaded it is removed from the mixer and ready to be made into pies. The workman immediately refills the mixer and starts the motor which is mixing the dough while he is busy making the pies.

Fig. 3 shows one of the pie machines, which together with three rotary ovens and a crust machine are run by a CE 4-5 horsepower, 635 revolution per minute direct current motor fastened to the ceiling.

The pie machine is about fifteen feet in length with a chain of endless dummy cast iron plates which run the whole length in the middle of this machine. As an iron plate comes upright a tin plate is set in it and then a small piece of dough is dropped in this. As this plate passes on a plunger presses down upon this dough and squashes out the bottom crust of the pie. This plate is still passing forward, and as it comes under the large tank in the center of the machine the required amount of filling is dropped into the pie, then the top crust put on and the last operation is the trimming. This is accomplished by a die coming down over the pie plate and neatly trimming the edges. The pie is now removed and put in the rack ready for baking.

Two of the three revolving ovens can be seen in the background of the picture. These are capable of holding 320 pies each at one time, and resemble a large paddle wheel. The pie plates are simply put on the paddle and the wheel set in motion; in this way all the pies are evenly baked.

Adjoining this room is the room where brown bread is made (Fig. 2). The machinery of this room is run by an I-8-7½ 900 revolution per minute induction motor, driving a short line of shafting, which in turn drives a J. H. Day dough mixing machine and also another machine which is

FIG. 6. REFRIGERATING MACHINE

used for screening pie filling. In this room the brown bread is prepared and then put in aluminum tins for baking. The baking is done by steam, and the daily output from this room is about 500 loaves, but on Friday the output is about 5,000 loaves. This large amount called for on that day goes to clearly show that the Bean City must have its brown bread and beans Saturday night.

The basement contains the seven cold storage rooms, the engine room, the small machines used for paring and coring the apples, also the ice refrigerating plant, which is driven by an I-6-25 horsepower 1200 revolution per minute three-phase General Electric motor. This refrigerating plant is sufficiently large to supply the seven rooms where eggs and such articles of food are kept. This motor is run both day and night.

The few illustrations which are here given will readily show the reader how far superior, especially for a bakery, the individual motor drive is as compared with steam engine or any other engine, whereby long lines of shafting and belts coming from one floor to the one above would have to be used.

Again, when we consider the most vital question of all, that is health, we must confess that the Ferguson Co. have as near an ideal bakery as can be found.

NEWS NOTES

FINANCIAL.

Chihuahua, Mexico.—A. J. Warren and C. D. Norton, formerly with the Parral Electric & Water Company, have acquired the electric light and power plant at Jimenez, Chihuahua.

Pasadena.—The City Council, after a discussion of the Cory report, has decided to ask for additional bond issues in two propositions, aggregating $200,000, to carry out recommendations of the report. One is the proposition of issuing $50,000 for completing the lighting plant as it now stands; the second to vote $150,000 to equip the plant for commercial lighting. The date for the election has been left for the regular session of the Council to decide.

Willows.—Reorganization of the Willows Water & Light Company has been effected by the election of the following officers and board of directors of the company: E. V. D. Johnson, of the Northern California Power Company, Redding, president; Sam Boyd, secretary and manager, formerly of Corning; P. H. Green, cashier Bank of Willows, vice-president; Frank Moody, attorney, Willows; Mr. French, farmer, Willows. The three latter were the principal stockholders in the old organization. Mr. Boyd, the new secretary and manager, formerly had charge of the Northern California Power Company's Corning office.

Los Angeles.—W. B. Mathews, attorney for the Los Angeles Aqueduct Commission, has been in Sacramento, where he met the Governor and members of the State Board of Examiners, securing from them a promise to modify the conditions of the State's acceptance of its half of the first issue of the Owens River bonds. The State Board had promised to take its half of the $1,020,000 issue, provided the Los Angeles financial institutions accepted the other $510,000. The present financial flurry caused a delay on the part of the city banks and trust companies, and the bond issue was held up. As the situation now stands, the State will take its part as soon as the bonds are engraved and Los Angeles institutions will be given time for the financial sky to clear. The bonds are being engraved by the American Bank Note Company of New York.

INCORPORATIONS.

Ventura.—The Ventura Gas & Electric Company has been incorporated with a capital stock of $250,000 by F. B. Cole, R. H. Brunham, D. H. Steels, H. C. Norris and others.

Los Angeles.—Articles of incorporation have been filed by the Big Six Oil Company. The capital stock is $24,000. The incorporators are G. B. Harrington, R. I. Irons, Edwin Nussbaum, G. H. Woodruff and F. D. McClure.

San Francisco.—The Monterey Land & Water Company has been incorporated at San Francisco with a capital stock of $200,000. The directors are D. Orbison, H. Harcourt, Joseph Forney, W. A. Hamilton and J. McElroy.

San Mateo.—Articles of incorporation have been filed by the South San Francisco Water Company with a capital stock of $150,000. The incorporators are: Leroy Hough, W. J. Martin, G. H. Chapman, E. R. and J. W. Lillienthal.

TRANSMISSION.

Eureka.—The North Mountain Power Company will install a large transformer of 1100 kilowatt power in its substation in the East End some time in January.

Sparks, Nev.—Plans submitted to the Oregon Short Line in Salt Lake by the engineering department give the details of a large power plant that it is proposed to construct on the Truckee River near Clarks, twenty-five miles east of Sparks.

Bridgeport.—Mr. Woodbury, a Nevada mining man, states that the water right and title have been perfected to the waters of Rush Creek, at the Inyo power plant site, and that work will be commenced on the plant early in the spring. Wm. Metson is now in Tonopah and Goldfield in behalf of the power company.

Santa Rosa.—The Board of Supervisors have sold a franchise to the Snow Mountain Water & Power Company for extending its electric transmission service in about twenty-five additional directions from the original franchise, which included only a number of the principal towns. Judge James W. Otes, representing the company, bid $250 for the franchise.

San Francisco.—The Snow Mountain Electric Power Company of California has been granted a perimt to occupy rights of way within the Stony Creek National Forest in Northern California for a dam sixteen feet high, a conduit approximately three miles long and a power house covering about three acres. The improvements will be for the purpose of generating electric power for commercial uses.

Quincy.—Col. E. D. Bannister more than a year ago located an important water right in Genesee Valley mining district, and since that time has been making surveys and cutting a ditch to convey the water to a point from which it can be dropped several hundred feet and be used in the development of electric power. It is understood that he and his associates intend to supply power to the Genesee and other mines, and furnish light for Genesee and Indian Valleys.

TELEPHONE AND TELEGRAPH.

Hanford.—The Board of Supervisors have granted to O. M. Harris a permit to construct a telephone line northwest of Hanford.

Washington, D. C.—Secretary Cortelyou has awarded to William Butler of San Francisco the contract for installing a duplicate telephone system in the Customs House of San Francisco.

San Francisco.—Led by Capt. George Ross, shipwright, creditors of the Occidental & Oriental Wireless Telegraph Company, have begun a campaign to collect some $10,000, claimed to be due them for building aerial stations from San Francisco to Los Angeles.

Berkeley.—A building permit has been secured by the Home Telephone Company for the erection of an office building at the corner of Milvia Street and Alston Way at a cost of $40,000. Coxhead & Coxhead of San Francisco are the architects, and L. H. Peterson, also of San Francisco, the builder. The permit calls for the erection of a two-story brick steel frame structure.

TRANSPORTATION.

Napa.—The Standard Portland Cement Company has determined to build a private electric line from its plant to the banks of Napa River, a distance of two and one-half miles.

Los Angeles.—According to A. J. Toolen, president of the North Pasadena Improvement Association, O. W. Potter, a wealthy resident of La Canada, has secured funds to build an electric railway through La Canada Valley, connecting Los Angeles and Pasadena.

Chico.—The bid of the Northern Electric Company to furnish 800 yards, more or less, of Stony Creek gravel at fifty-five cents per ton to the city of Chico has been accepted at a meeting of the City Council, subject to certain provisions dealing with high water, etc.

San Francisco.—General Manager Charles N. Black, of the United Railroads, expects to have 100 more cars in operation within ten days. He says the work of installing the necessary machinery to transform the current, to be supplied by the City Electric Company, is progressing rapidly.

San Francisco.—At a recent meeting of the Board of Supervisors, the report of City Engineer Woodward recommending that an expenditure of $1,272,000 to construct an entirely new street railway over the route of the Geary Street road would be preferable to a partial reconstruction by the city at an estimated initial cost of $965,000, and $665,000 for repairs after the first five years of service, was referred to the Public Utilities Committee.

San Francisco.—A petition of 6000 names has been filed with the Supervisors requesting that a special election be called within sixty days to submit to the voters two charter amendments, one designed to allow two lines of street railways owned by different companies to be operated on the same street for a distance of thirty-one instead of ten consecutive blocks, as at present; the other providing that fifteen per cent of the electors may compel action upon pending railway franchise petitions.

Vallejo.—Track laying on the Napa Valley Electric road from Oak Knoll to St. Helena has been resumed, and Manager Petry announces that a date much earlier than Christmas day will see the road running into St. Helena. At that time an hourly service will be inaugurated between Vallejo and St. Helena, and the distance of thirty-two miles will be made in one hour and thirty minutes. Three flyers will be put on to connect with three of the trips of the Monticello Steamship Company of Vallejo, and the upper Napa Valley will have another competing line. It is understood that if the rights of way can be secured at a moderate cost the nine-mile extension from St. Helena to Calistoga will be operated within another year.

Los Angeles.—Practically all construction work on Harriman's Los Angeles Pacific Electric Railway was abruptly stopped last week on instructions from the East. Three hundred men engaged in placing new ties and standard-gauging the lines were discharged without notice. Even high officials say they did not know a cut was intended. Only enough force is retained to do repair work and to build the Hill Street tunnel. Rumors that even further retrenchment, affecting the operating department, is coming, caused consternation among the thousands of employes. Platform men feel particularly insecure in their positions. The company made this statement: "There is considerable work which had been planned which it is not necessary to complete at this time. In view of the present condition of the money market and the general plan of retrenchment instituted some time ago, this work has been postponed until some future time. The installation of the three-rail system and the completion of the tunnel will not be affected. Both of these improvements will be pushed through to completion."

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